

REMARKS

Applicants respectfully request Examiner Nguyen admit this Amendment which has been drafted to place subject divisional Application in condition for allowance, and alternatively to place rejected 5 claims in better form for consideration on appeal. In particular, Claims 34 and 39 have been canceled without prejudice, and claims 31, 32, 35 37 and 38 have been amended to more particularly point out and distinctly claim the subject matter which applicants regard as the invention.

Applicants note with appreciation that all rejection of claims under 10 35 U.S.C. § 112 has been withdrawn by Examiner Nguyen.

Claim 31 directed Applicants' novel process for the production of refinery transportation fuel or blending components for refinery transportation fuel, has bee amended to recite: "--the presence of a hydrogenation catalyst to assist by hydrogenation removal of sulfur 15 and/or nitrogen from hydrotreated distillate; and comprises one or more active metals selected from the group consisting of the elements having atomic numbers from 21 to 30, 39 to 48, and 72 to 78--". Support for this amendment is found in the specification, for example at paragraph [0030].

Claim 31 has also been amended to recite: "--a particulate, heterogeneous oxygenation catalyst system which exhibits a capability to enhance the incorporation of oxygen into a mixture of liquid organic compounds and comprises one or more member catalyst-metal selected from the group consisting of (a) an oxygenation catalyst containing 25 from 1 percent to 30 percent chromium as oxide and from 0.1 percent to 5 percent platinum on a support comprising gamma alumina, (b) comprises chromium molybdate or bismuth molybdate and optionally magnesium, and (c) gamma alumina and a catalyst represented by the formula Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> in an amount of from 0.1 30 percent to 1.5 percent of the total catalyst system, while maintaining

the reaction medium substantially free of halogen and/or halogen-containing compounds—”. Support for this amendment is found in the specification, for example at paragraphs [0034] and [0035] and Examples 3 to 6, and claims 37 to 39.

5        Claim 33 has been amended to recite the limitation of dependent claim 34 “—blending at least a portion of the low-boiling oxygenated product with at least a portion of the high-boiling product thereby obtaining components that exhibit sulfur levels of less than about 15 ppm, for refinery blending of ultra-low sulfur transportation fuels.”

10      Claim 35 has been amended to recite Applicants’ novel “--process according to claim 33 wherein the hydrogenation catalyst comprises at least two active metals, selected from the group consisting of cobalt, nickel, molybdenum and tungsten, each incorporated onto an inert support in an amount of from about 0.1 percent to about 20 percent by weight of the total catalyst.” Support for this amendment is found in the specification, for example at paragraph [0031].

20      Claim 37 has been amended to recite Applicants’ novel “--process according to claim 31 wherein the heterogeneous oxygenation catalyst system comprises an oxygenation catalyst containing about 18 percent chromium as oxide and about 1.5 percent platinum on a support comprising gamma alumina.” Support for this amendment is found in the specification, for example at examples 4 and 6.

25      Claim 38 has been amended to recite Applicants’ novel “--process according to claim 31 wherein the heterogeneous oxygenation catalyst system comprises bismuth molybdate promoted with magnesium.” Support for this amendment is found in the specification, for example at examples 3 and 5.

30      In view of these amendments on the claims, Applicants respectfully request Examiner Nguyen to withdraw his rejection under 35 U.S.C. § 103(a) of claims 31 to 38, all claims now presented.

**Claim Rejections - 35 U.S.C. § 103(a)**

In outstanding Office Action, Claims 31 to 29 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Brownawell et al. (EP-0 5 252 606) in view of Schultz et al. (US 2,365,220) and Farkas et al. (US 2,472,152). Applicants respectfully traverse these rejections.

The Brownawell et al. reference of record describes a process said to increase the cetane number of a middle distillate fuel fraction by using one or more non-oxide catalytic metals to selectively oxidize benzylic carbon atoms present in the fuel distillate to ketones. Prior to oxidation in this process, it is preferred to hydrotreat the fuel distillate to reduce the sulfur and nitrogen content thereof and increase the number of benzylic carbon atoms (page 4, lines 41 to 48). In fact, however, typically hydrotreated distillate contains undesirable high levels of sulfur and nitrogen. For example see the elemental analysis of the unoxidized material at page 23, lines 36 to 41 where Brownawell et al. reports sulfur at 0.74 weight percent (7,400 ppm) and nitrogen up to 0.35 weight percent (3,500 ppm) for starting material.

Preferably, Brownawell et al. states, the non-oxide catalyst will be one or more oil or water soluble compounds. On the other hand, the non-oxide catalytic metal compound may be insoluble in both oil and water. In non-preferred cases, the insoluble, non-oxide catalytic metal compound may be in a bulk form or supported on a suitable support material (page 5, lines 27 to 32). The Brownawell et al. reference of record does not define or illustrate the meaning of the term "suitable support material." All of the working examples in the reference of record use oil soluble metal salts; copper sulfate pentahydrate in Examples 1 to 3, and cobalt naphthenate (6% Co) catalyst solution in Examples 4 to 6.

By contrast, prior to oxidation Applicants' novel process requires 30 "partitioning by distillation the hydrotreated distillate to provide at least

one low-boiling organic part consisting of a sulfur-lean, mono-aromatic-rich fraction collected below a temperature in the range from 260° C. to 300° C., and a high-boiling organic part consisting of a sulfur-rich, mono-aromatic-lean fraction.”

5        Thereafter a portion of the low-boiling organic part is contacted  
with a gaseous source of dioxygen “in a liquid reaction medium  
containing a particulate, heterogeneous oxygenation catalyst system  
which exhibits a capability to enhance the incorporation of oxygen into a  
mixture of liquid organic compounds and comprises one or more member  
10 selected from the group consisting of (a) an oxygenation catalyst  
containing from 1 percent to 30 percent chromium as oxide and from 0.1  
percent to 5 percent platinum on a support comprising gamma alumina,  
(b) comprises chromium molybdate or bismuth molybdate and optionally  
magnesium, and (c) gamma alumina and a catalyst represented by the  
15 formula Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> in an amount of from 0.1 percent to 1.5 percent of the  
total catalyst system, while maintaining the reaction medium substantially  
free of halogen and/or halogen-containing compounds.” Claim 31 recites  
recovery of “boiling oxygenated product having a low content of  
nitrogen, acidic co-products and a sulfur content of no more than 15  
20 ppm.” Analyses of Applicants’ organic liquid of low density determined  
sulfur contents below 10 ppm and even as low as 6 ppm (see Example 7).

As noted by Examiner, example 1 in the Brownawell et al.  
reference of record shows that sulfur content is decreased form 0.74  
weight percent to 0.42 weight percent (4,200 ppm). By contrast instant  
25 claims are directed to a product with a sulfur content of no more than 15  
ppm. It is the position of Applicants that processes described in the EP  
reference are different in kind, not merely degree, from Applicants’ novel  
processes.

Applicants respectfully submit that the prosecution of this  
30 application has become so involved with citing references to individual

elements of Applicants novel process that one “can’t see the forest for the trees.”

As Examiner notes, Brownawell et al. (the EP reference) does not disclose partitioning by distillation the hydrotreated distillate to provide at least one low-boiling organic part consisting of a sulfur-lean, mono-aromatic-rich fraction collected below a temperature in the range from 260° C. to 300° C., and a high-boiling organic part consisting of a sulfur-rich, mono-aromatic-lean fraction. Applicants believe it is important to understand that collecting the low-boiling organic part (consisting of a sulfur-lean, mono-aromatic-rich fraction) below a temperature in the range from 260° C. to 300° C is a critical element of their novel invention. In particular this low-boiling fraction has a suitably low boiling end-point such that when this fraction is oxygenated, the resulting increase in the final boiling point is no higher than the maximum end-point of the refinery fuel specification. At the same time Applicants’ critical cut-point provides a low-boiling fraction that is both sulfur-lean, mono-aromatic-rich.

The Schultz et al. reference of record is directed to attainment of minimum engine knocking by using a Diesel fuel comprising organic peroxides formed by non-catalytic contact with air, oxygen or an oxygen-carrying gas at 290 to 300° F. Thereafter, “the oil was washed with water to remove calcium salts of organic acids (by partial solution and suspension in the water) and free acids were then removed by scrubbing with 5% caustic soda solution in very small excess only, after which the scrubbed oil was again water-washed” (Schultz et al., page 2, right col., lines 1 to 18). Without this neutralization of acidic co-products, the peroxides formed, which are unstable in the presence of the free acids, would go away before the fuel could be used.

Farkas et al. is directed to preparation of high cetane number Diesel engine fuel by adding organic peroxides and/or organic hydroperoxides thereto. Farkas et al. “prefer to effect the oxidation in the presence of a

basically reacting agent which will form slats with acids which are produced during the oxidation thus effectively removing said acids which as indicated hereinabove, appear to be catalysts for the decomposition of peroxides" (Farkas et al., col. 9 lines 30 to 36). reference describes neutralizing acids in hydrocarbon effluent from non-catalytic oxidation, but does not disclose or suggest a presence of any sulfur or nitrogen containing compounds.

It is the position of Applicants that combination of Brownawell et al. with Schultz et al. and/or Farkas et al. references of record does not disclose or suggest Applicants' novel process.

Claims 33, 35 and 36 are in condition for allowance for the additional reasons that the references of record do not disclose or suggest Applicants' novel process "which further comprises contacting least a portion of the high-boiling organic part with an immiscible phase comprising at least one organic peracid or precursors of organic peracid in a liquid reaction mixture maintained substantially free of catalytic active metals and/or active metal-containing compounds and under conditions suitable for oxidation of one or more of the sulfur-containing and/or nitrogen-containing organic compounds; separating at least a portion of the immiscible peracid-containing phase from the oxidized phase of the reaction mixture; contacting the oxidized phase of the reaction mixture with a solid sorbent, an ion exchange resin, and/or a suitable immiscible liquid containing a solvent or a soluble basic chemical compound, to obtain a high-boiling product containing less sulfur and/or less nitrogen than the high-boiling fraction; and blending at least a portion of the low-boiling oxygenated product with at least a portion of the high-boiling product thereby obtaining components that exhibit sulfur levels of less than about 15 ppm, for refinery blending of ultra-low sulfur transportation fuels".

Claim 35 has been amended to recite a preferred embodiment of Applicants' novel process according to claim 33 wherein the hydrogenation catalyst comprises at least two active metals, selected from

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the group consisting of cobalt, nickel, molybdenum and tungsten, each incorporated onto an inert support in an amount of from about 0.1 percent to about 20 percent by weight of the total catalyst.

- Claims 31 to 33, 35 to 38, inclusive, are in condition for allowance.
- 5   Applicant respectfully requests Examiner Nguyen to pass subject application for allowance.

Do not hesitate to contact Frederick S. Jerome whose telephone number is (630) 832-7974 (FAX (630) 832-7976) if additional assistance is needed regarding this paper or earlier papers for Applicants.

- 10   Applicants and their undersigned Attorney appreciate Examiner's attention and consideration of this matter.

Respectfully submitted,



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